Gestural channel

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While gestures and actions are getting more and more important in theories – such as the theory of enaction – and in technology – such as the technologies of multimodal interfaces, or the technologies of gesture devices – the definition of a terminology adapted to the different functions involved in the relation between the actuations and the perceptual modalities is of a critical importance. One is forced to observe that the today's term of haptic is unable neither to cover the needs, nor to sufficiently simply and clearly support detailed discussions and developments [→ Haptics, haptic devices] [→ Haptics, in cognitive sciences].

Facing this problem, Cadoz has introduced the expression "gestural channel", as a compact mean to name elegantly all the human biomechanical sensors-actuators involved in physical motor performance, and its declinations in "gestural action" and "gestural perception" [Cadoz, 1994] [Cadoz 2000].

- The gestural channel is defined as the sensori-motor channel composed of all the physical means, through which the human physical body interacts with the physical external universe: hand, body equipped with all its mechanoreceptors and all its actuators. Gestures are then the result of the use of the sensors-actuators of the human gestural channel apparatus during the performance.
- The gestural action is the motor part of the gestural channel involved in the gesture performance. It involves all the physical components (articulated skeleton and muscles) of the body.
- The gestural perception is the sensory part of the gestural channel.

The gestural channel is hence the sum of gestural action and gestural perception.

These terms (gestural channel, gestural perception, gestural action) are used to avoid the unneeded detailed description of each sub-means (subset of sensors, subset of motor capabilities), and of the human perceptual and/or cognitive results of the use of these means. Several reasons justify the need of this specific new terminology.

A first motivation is that the word gesture embeds the idea of a task, of a goal. Conversely, haptics" does not. Indeed, in daily life, we talk usually more of gesture than of haptics: the gesture of the craftsman, the gesture of the violonist, learning the gesture of writing…

A second, and more important, motivation is that the term haptics focuses principally on the perception side. If the expression haptic perception is valid, one never talks of haptic action. Indeed, in the use of the term haptics, action remains implicit, so as the grouping of action and perception, which is inherent in human gesture.

A third motivation, which is crucial, is that a major function of a terminology is to support technological clarification, according to the observation that the language of a civilization is also the language of its *techné* and that a language disappears when it is no longer able to define its own technological terms involved in the daily professional life.

This leads to have at disposal a terminology from the needs of the technology, and of the task performed, beside the point of view of the human system.

The needs of technology

From the points of view of the technology, the term haptics is very fuzzy. It does not allow distinguishing between technologies as different as a mouse, a tactile actuator, a motion capture system, a force feedback device, etc. because some of these technology address action only (ex: mouse, motion cap-

ture), some of them address perception only (ex: tactile actuator), and others address the grouping of both action and perception (ex: force feedback device) – whereas, as said before, haptics does not allow referring explicitly to action.

More generally, it is really necessary to have 3 terms available in the case of gesture.

On can consider that, whereas the visual channel and auditory channel are only perceptive channels, human's gesture embeds deeply action and perception. Both are always associated in human gesture performances. In the case of gesture, the sensory channel is intimately linked with the associated actuator channel. The term haptics carries correctly this very important idea.

However, when electrical technology gets into the way, this unity of human body as for action/perception with gesture is necessarily broken. Gesture devices feature necessarily separated actuators and sensors, and we need words to take this irreducible property of the technology when talking, in the context of technology, of the whole human gesture system. In other words, we need to be able to talk separately of the gestural action, which is to be perceived by sensors, and of the gestural perception, which is addressed by effectors. However, we need also to be able to talk of their grouping - that is, of the gestural channel. Haptics, as a matter of fact, does not allow covering these three needs. The three proposed terms are, here, efficient and practical.

But even with non-electrical mechanical technologies, humans developed a large panoply of systems in order to adapt the gestures performed to the tasks and in which the respective weight of action and of perception differs. Some of them necessitate a huge energetic involvement, some of them not. Instruments have been designed to be adapted to the necessary actions. For example, taking the example of a clarinet, there are two types of gestures:

- those (the breath) by which the sound is produced, in which the energy in the sound originates, and that necessitates a strong physical involvement of the player that plays an important role in the quality and the type of the sound produced;
- and those that consist in modifying the properties of the sound such as the pitch (by the keys). For the latest category of gesture, specific mechanical means were invented that makes minimal and optimize the energetic involvement of the player.

The needs of the tasks

Regarding the needs of the tasks, three categories of gesture can be distinguished, leading to the development of specific technologies, technologies for action, technologies for perception, technologies for the link between actions and perceptions.

There are gestures in which the gestural perception does not plays an important role, in the sense that it can be performed in various perceptual situations. De facto, a technical mediation is developed to allow achieving the desired result no matter how the gesture is performed. We can call this situation "gestural action with low role of gestural perception". In the tripartite typology of interaction functions proposed by Cadoz [→ Ergotic/epistemic/semiotic functions] [Cadoz 1994] [Cadoz, 2000], this type of gestural action corresponds to the semiotic function of the gestural channel. Keyboard writing is of that type.

On the contrary, there are gesture that involve a lot gestural perception, but with a small role of gestural action. These correspond to what Hatwell [Hatwell & al., 2003] called *Touching for knowing*, i.e., in the Cadoz' typology, to an epistemic function of the gestural channel. As a matter of fact, and unfortunately, most of the knowledge today on haptic modality corresponds to this case.

And finally, there are tasks in which the correlation between the gestural action and the gestural perception plays a critical role, not only in the performance (for example to improve its efficiency, its acceptability, or its intuitiveness), but also in the result of the

gesture. Best examples are in craftsmanship, high-level professional gestures, sports or artistic performances. In such tasks, gestural action and gestural perception constitute a kind of closed-loop system that cannot be realized by only superimposing a semiotic gestural action and an epistemic gestural perception. Something new is added, which is the energetic or physical coupling between them that cannot be modelled without calling the help of the concepts and theory of dynamic systems. A new term, ergotic, was specifically dedicated to that ergotic function of the gestural channel [→ Interface, ergotic] [Cadoz, 1994] [Cadoz, 2000].

References

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Related items

Ergotic/epistemic/semiotic functions
Gesture / movement / action
Haptics, haptic devices
Haptics, in cognitive sciences
Instrumental interaction
Interface, ergotic